Recognition and Response

An Early Intervening System for Young Children At-Risk for Learning Disabilities

Research Synthesis and Recommendations

May 1, 2006

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Suggested citation: Coleman, M. R., Buysse, V., & Neitzel, J. (2006). *Recognition and response: An early intervening system for young children at risk for learning disabilities. Full report*. Chapel Hill: The University of North Carolina at Chapel Hill, FPG Child Development Institute.

Executive Summary

SOME YOUNG CHILDREN show signs that they may not be learning in an expected manner, even before they begin kindergarten. These children may exhibit problems in areas such as language development, phonological awareness, perceptual-motor abilities, and attention, which have been considered precursors of learning disabilities in older children. However, under current state and federal guidelines, these children are unlikely to meet eligibility criteria for having a learning disability.

This document describes what is known about an early intervening system being developed for young children (i.e., 3 to 5 year-olds), called Recognition and Response. The Recognition and Response system is an emerging early childhood practice designed to help parents and teachers respond to learning difficulties in young children who may be at risk for learning disabilities as early as possible, beginning at age 3 or 4, before they experience school failure and before they are referred for formal evaluation and possible placement in special education. Support for the concept of early intervening can be found in the reauthorization of the Individuals with Disabilities Education Act (IDEA) and in the Response to Intervention (RTI) model for school-age children.

The Origins of Recognition and Response in Response to Intervention (RTI)

The Response to Intervention (RTI) model for school-age children who are at-risk for learning disabilities emphasizes pre-referral prevention and intervention. RTI can be distinguished from traditional methods of identifying learning disabilities in that it allows early and intensive interventions based on learning characteristics and does not wait for children to fail before providing necessary services and supports. The major premise of RTI is that early intervening services can both prevent academic problems for many students who experience learning difficulties and determine which students actually have learning disabilities, as distinct from those whose underachievement can be attributed to other factors such as inadequate instruction.

Although several variations of the model have been proposed, in general RTI is based upon three components: (a) the use of multiple tiers of increasingly intense interventions; (b) a problem-solving approach to identify and evaluate instructional strategies; and (c) an integrated data collection and assessment system to monitor student progress and guide decisions at every level. In recent years, a standard treatment protocol—the use of a particular research-based intervention for a small group of children with similar needs—has emerged as an additional RTI practice.

Critical Contexts in the Early Childhood Field

Several critical contexts in the early childhood field have caused national attention to be focused on early education issues and have helped to influence attitudes about the importance of services for very young children and their families: (a) the emphasis on high quality care and education, (b) the school readiness movement, (c) the national pre-kindergarten movement, and (d) the importance of prevention and early intervention. Each of these contexts reflects important factors that must be considered in developing an early intervening system for young children prior to beginning kindergarten.

Establishing an Evidence Base for the Recognition and Response System

The conceptual framework for the Recognition and Response system is being developed with grant support from the Emily Hall Tremaine Foundation (http://www.tremainefoundation.org) through a collaborative effort that involves the FPG Child Development Institute, The National Center for Learning Disabilities, the National Association for the Education of Young Children, the Communication Consortium Media Center, and key state partners. The work is being accomplished through two primary activities: (1) a comprehensive review of the literature to produce a research synthesis on RTI and (2) a series of focused discussions with the collaborating organizations and partners to develop a conceptual framework for the Recognition and Response system adapted from the RTI model.

Research Synthesis on RTI

A total of 14 studies met the selection criteria for inclusion in the review and served as the current research base regarding the efficacy of RTI. Analyses included an appraisal of the quality of research methods as well as descriptions of the characteristics of study participants, the nature of the interventions, and methods of assessing student progress and outcomes. The findings suggest that there is an emerging body of empirical evidence to support claims that RTI is an effective method for identifying children at risk for learning difficulties and for providing specialized interventions, either to ameliorate or to prevent the occurrence of learning disabilities. Although there was general agreement across studies about the conceptualization of RTI in terms of its key components and tiered implementation, there was less agreement about the nature and focus of specialized interventions, the duration or intensity of the interventions, and the benchmarks used to determine when more intensive interventions were needed for individual children. Despite these limitations, the research synthesis findings suggest that RTI is a promising approach, particularly because of its focus on sound instructional principles such as effectively teaching all children, intervening early, using research-based interventions, monitoring student progress, and using assessments to inform instructional decision-making.

A Conceptual Framework for the Recognition and Response System

The proposed Recognition and Response system is based on the premise that parents and teachers can learn to recognize critical early warning signs that a young child may not be learning in an expected manner and to respond in ways that positively affect a child's early school success. In the Recognition and Response system, there is limited reliance on formal diagnosis and labeling. Instead, the Recognition and Response system emphasizes a systematic approach to responding to early learning difficulties that includes assessing the overall quality of early learning experiences for all children and making program modifications, tailoring instructional strategies, and providing appropriate supports for individual children who struggle to learn.

The Recognition and Response system includes four essential components: (1) an intervention hierarchy; (2) screening, assessment, and progress monitoring; (3) research-based curriculum, instruction, and focused interventions; and (4) a collaborative problem-solving process for decision-making. Future efforts should focus on further developing and evaluating each component as part of an integrated system, particularly with respect to identifying the specific assessment and instructional strategies within each of the tiers in the intervention hierarchy. Figure A shows the four components of the Recognition and Response system.

Figure A

Recognition and Response System for Early Intervening
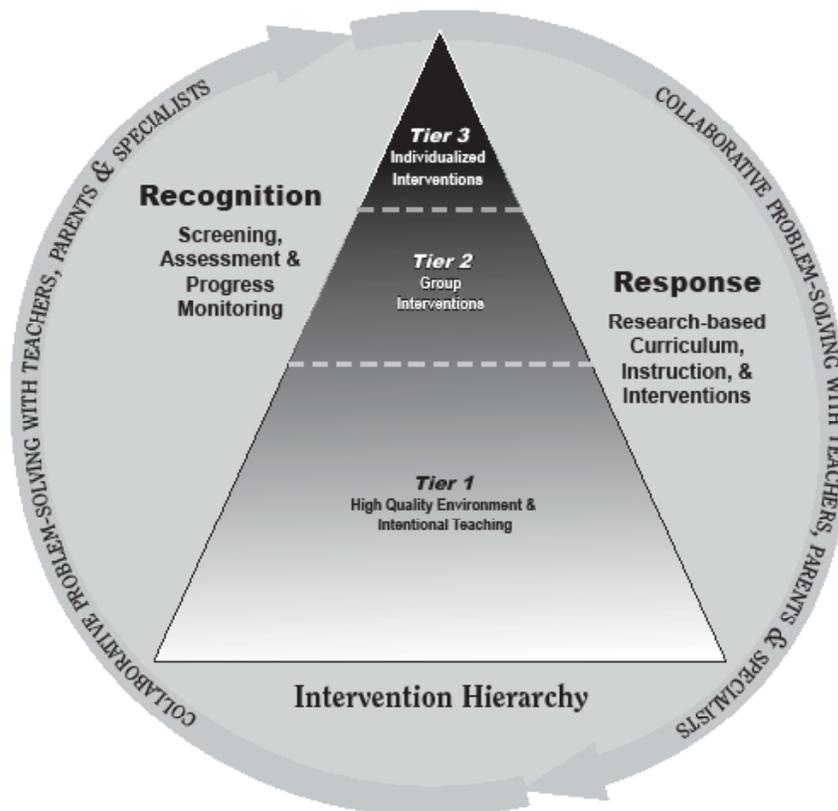
Intervention Hierarchy

An intervention hierarchy reflects increasing levels of intensity of instruction and intervention that correspond directly to children's needs for support. A teacher's decision to move from one tier to the next is guided by screening and assessment information as part of a systematic and collaborative problem-solving process that includes parents and specialists.

Screening, Assessment, and Progress Monitoring

An integrated assessment plan that relies on multiple methods and sources of information (e.g., observation, checklists, work sampling, curriculum-based assessments) can be used to determine which children are meeting key benchmarks, which children are in the process of developing these skills, and which children are not making adequate progress.

Research-Based Curriculum, Instruction, and Focused Interventions

The overarching goal of the Recognition and Response System is for teachers to use assessment as part of an integrated instructional system to make improvements in the general early childhood program and to plan focused interventions for children who require additional supports. Future efforts should focus on identifying standard research-based interventions that would comprise a "toolkit" from which teachers could extract specific practices to respond to individual learning characteristics within each tier of an intervention hierarchy.

Collaborative Problem-Solving Process for Decision-Making

Key to the problem-solving process is the use of assessments to inform decisions, thus, creating a dynamic link between the recognition and response components. The problem-solving process is collaborative, systematic, and used by teachers, parents, and specialists to make decisions about practice and to evaluate their effectiveness for individual children.

Recommendations for the Early Childhood Field

The following recommendations address the need to support future development, evaluation, and adoption of the Recognition and Response system:

1. Further develop the Recognition and Response system by (a) specifying in more detail each of the four components (i.e., an intervention hierarchy; screening, assessment, and progress monitoring; research-based curriculum, instruction, and focused interventions; a collaborative problem-solving process for decision-making) and (b) creating the tools and resources related to implementing each component.

2. Evaluate the efficacy and effectiveness of the Recognition and Response system through future research.

3. Use professional development as the primary vehicle for disseminating information about the Recognition and Response system to front line early childhood professionals—teachers, specialists, and administrators.

4. Develop and evaluate dissemination strategies (consisting of print, electronic, and oral presentation methods) to communicate information about the Recognition and Response system with a wide audience that includes parents of young children, researchers, policy makers, and the general public.

5. Develop (or adapt) existing public policies related to program standards and professional competencies to support the widespread adoption and implementation of the Recognition and Response system throughout various sectors of the early childhood field (e.g., child care centers and homes, public and private pre-k programs, Head Start). ■

Introduction

A PRE-KINDERGARTEN TEACHER is concerned about a 4 year-old who has mild language delays and who is not making adequate progress in acquiring early literacy skills, such as recognizing the letters in the alphabet and printing her name. A parent of a kindergartner is worried that her child's comprehension problems, his inability to pay attention to the teacher, and his poor spatial memory may be causing him to fall behind his peers in academic subjects.

In each of these examples, a teacher or a parent has recognized critical early warning signs that a young child may not be learning in an expected manner. Both children exhibit problems in areas such as language development, phonological awareness, perceptual-motor abilities, and attention that have been considered precursors of learning disabilities in older children (Catts, 1991; Lowenthal, 1998). Although special education is designed to identify children with disabilities who require specialized instruction or curricular accommodations, neither of these children is likely to meet the eligibility criteria for having a learning disability under current state and federal guidelines. This is because formal identification of a child's learning disability generally does not occur until there is a measurable discrepancy between the child's aptitude and academic achievement, often not until the second or third grade.

The Recognition and Response system is being designed to help parents and teachers respond to learning difficulties in young children who may be at risk for learning disabilities as early as possible, beginning at age 3 or 4, before children experience school failure and before they are referred for formal assessment and placement in special education. Equally as important, a Recognition and Response system could prevent learning and behavioral problems from occurring later in a child's academic career. Ultimately, this could result in fewer children who either are retained or identified as having specific learning disabilities and who require special education services.

The purpose of this document is to describe what is known about an early intervening system that is being developed for prekindergartners (i.e., 3 to 5 year-olds) called Recognition and Response and to offer guidelines for future research, policy, and practice in this area. The document is organized around the following topics: (1) the origins of Recognition and Response in the Response to Intervention (RTI) model that is currently being developed for school-age children; (2) major trends in the early childhood field that serve as a context and an impetus for implementing Recognition and Response prior to kindergarten; (3) the evidence base for using a Recognition and Response system prior to kindergarten, focusing

on the empirical evidence of RTI, as well as the early childhood field's collective wisdom and values; (4) a conceptual framework for the Recognition and Response system; and (5) recommendations for the early childhood field regarding the need for further development and evaluation of the Recognition and Response system.

The Origins of the Recognition and Response System in Response to Intervention (RTI)

THIS SECTION will examine the historical context and a conceptual framework for current practices related to the identification of children with learning disabilities.

Defining Learning Disabilities

It has been over 40 years since Samuel Kirk first coined the term *learning disabilities* to describe children who, despite having average or above average intelligence, failed to learn in an expected way (Kirk, Gallagher, Anastasiow, & Coleman, 2006). Kirk observed that the learning difficulties these children encountered appeared to be related to problems with processing information that were thought to stem from neurological impairments. Although Kirk believed that these children likely would be a very small subset of the total number of children with disabilities, today children with learning disabilities have become the largest group of students served by the special education system. Recent estimates suggest that the number of students identified as having learning disabilities has increased more than 200% since the category was established in 1977 (Bradley, Danielson, & Doolittle, 2005).

One explanation for the large proportion of children identified as having learning disabilities comes from the way in which the term traditionally has been defined. The Individuals with Disabilities Education Act (IDEA; reauthorized as the Individuals with Disabilities Education Improvement Act, 2004) provides the following definition of a specific learning disability:

SEC. 602. DEFINITIONS.

"(30) SPECIFIC LEARNING DISABILTIY.—

(A) IN GENERAL.—The term 'specific learning disability' means a disorder in 1 or more of the basic psychological processes involved in understanding or in using language, spoken, or written, which disorder may manifest itself in the imperfect ability to listen, think, speak, write, spell, or do mathematical calculations.

(B) DISORDERS INCLUDE.—Such term includes such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.

(C) DISORDERS NOT INCLUDED.—Such term does not include a learning problem that is primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage."

To operationalize this definition, most states have developed formulas that hinge on establishing a discrepancy between children's intellectual abilities (IQ) and their achievement and/or performance. Researchers have identified a number of problems with the so-called discrepancy model used to identify children with learning disabilities that are well documented in the literature (Conyers, Reynolds, & Ou, 2003; Fuchs, Mock, Morgan, & Young, 2003; Speece, Case, & Malloy, 2003; Gerber, et al., 2004; Kavale, Holdnack, & Mostert, 2005; O'Connor, 2000). The problems with this model can be summarized as follows: (1) discrepancies between IQ and achievement/performance are difficult to measure in young children who are just beginning their academic careers; (2) discrepancies between IQ and achievement/performance may exist for any number of reasons and, as a result, this approach identifies children with *unexplained underachievement* that may or may not be due to a learning disability; (3) the discrepancy model requires waiting until the gap between IQ and achievement/performance is wide enough to measure, which means that a child often experiences repeated school failure before being identified as learning disabled; (4) the wait-to-fail approach creates a situation in which the primary academic problems that a child experiences worsen and often are compounded by secondary problems in areas such as behavior and emotion regulation, self-esteem, and peer relations; and (5) the discrepancy model results in an overrepresentation of children from diverse cultural and linguistic groups who are classified as having learning disabilities.

Response to Intervention (RTI)

The Response to Intervention (RTI) model for school-age children emphasizes pre-referral prevention and intervention of learning difficulties. The origins of RTI have been attributed to Deno's data-based program modification model (i.e., using curriculum-based measures that are sensitive to student growth to plan and evaluate instruction) (Deno, 1985; Deno & Mirkin, 1977) and Bergan's behavioral (i.e., problem-solving) consultation model (Bergan, 1977; Bergan & Kratochwill, 1990), both of which reflect critical components of RTI (National Association of State Directors of Special Education; NASDSE, 2005). Expanded in important ways by numerous researchers since then (see for example Fuchs, 2003; Fuchs & Fuchs, 2002; Fuchs, Fuchs, & Compton, 2004; Marston, Muyskens, Lau, & Canter, 2003; Speece, Case, & Molloy, 2003; Torgesen, et al., 1999; Vaughn & Fuchs, 2003; Vaughn, Linan-Thompson, & Hickman, 2003; Vellutino, et al., 1996), RTI now dominates national discussions on the identification of learning disabilities, with entire journal issues devoted to this topic (see *Learning Disabilities Research and Practice*, 2003, Vol. 18, No. 3; *Learning Disabilities Quarterly*, 2005, Vol. 25, No. 1; and *Journal of Learning Disabilities,* 2005, Vol. 38, No. 6).

RTI can be distinguished from the discrepancy model in that it allows for early and intensive interventions based on learning characteristics and needs, rather than waiting for children to fail, and it promotes a collaborative approach to delivering supports and services (Vaughn & Fuchs, 2003; Fuchs, 2003). The major premise of RTI is that early intervening

services can both prevent academic problems for many students who are having learning difficulties and determine which students actually have learning disabilities versus those whose underachievement can be attributed to other factors, such as inadequate instruction. In addition, because RTI includes an emphasis on the quality of the general education curriculum and instruction, the model offers potential benefits to every student and not just to those who experience some type of learning problem.

Although several variations of the model have been proposed, in general, RTI is based upon three components: (1) the use of multiple tiers of intervention with increasingly intense interventions that guide its implementation; (2) a problem-solving approach that provides educators with a step-by-step process to identify and analyze problems, develop a plan, and evaluate the efficacy of interventions; and (3) an integrated data collection/assessment system to guide decision making in each tier of service delivery (NASDSE, 2005; Blankstein & Cocozzella, 2004; Fuchs, 2003; Kamps & Greenwood, 2005; Marston et al., 2003; O'Shaughnessy, Lane, Gresham, & Beebe-Frankenberger, 2003). In recent years, a standard treatment protocol has emerged as an additional RTI practice, often used in combination with other components of RTI (NASDSE, 2005). The standard treatment protocol approach involves the use of a particular research-based intervention for a small group of children with similar problems in a given domain (Fuchs, Mock, Morgan, & Young, 2003).

Both three- and four-tier models of RTI have been described in the literature. Reschly (2005) observed that there is widespread agreement that the first tier reflects general education and the final tier reflects special education, but questions remain about whether one or two tiers come between these points. The author suggested that a possible solution is to view Tiers 1 and 2 as classroom prevention steps and Tier 3 as a combination of prevention and eligibility determination. Figure 1 displays the three-tier RTI model described by the National Association of State Directors of Special Education (2005).

Tier 1 is designed to help teachers be preventive and proactive by (1) providing high quality instruction as an essential foundation for learning for all students, and (2) determining which students may need additional instructional interventions to make adequate progress. In Tier 1, all students are screened to determine whether the curriculum and instruction offered in the general education program are sufficiently supportive to meet the educational needs of most children. If 80% of the children in a particular classroom meet pre-determined academic and behavioral benchmarks, then the general education curriculum is presumed to be of sufficient quality. If the 80% criterion is not met, then classroom-level intervention to improve the quality of instruction should be implemented. In Tier 2, targeted group interventions within the general education classroom are used to address the needs of the students who do not make adequate progress in Tier 1, even when the general education curriculum is deemed to be of high quality. Teachers are encouraged to intervene with these students in Tier 2 by using differentiated instructional methods, such as curriculum-modifications, small group instruction, or standard treatment protocols. Teachers can antic-

Figure 1
Three-Tier RTI Model
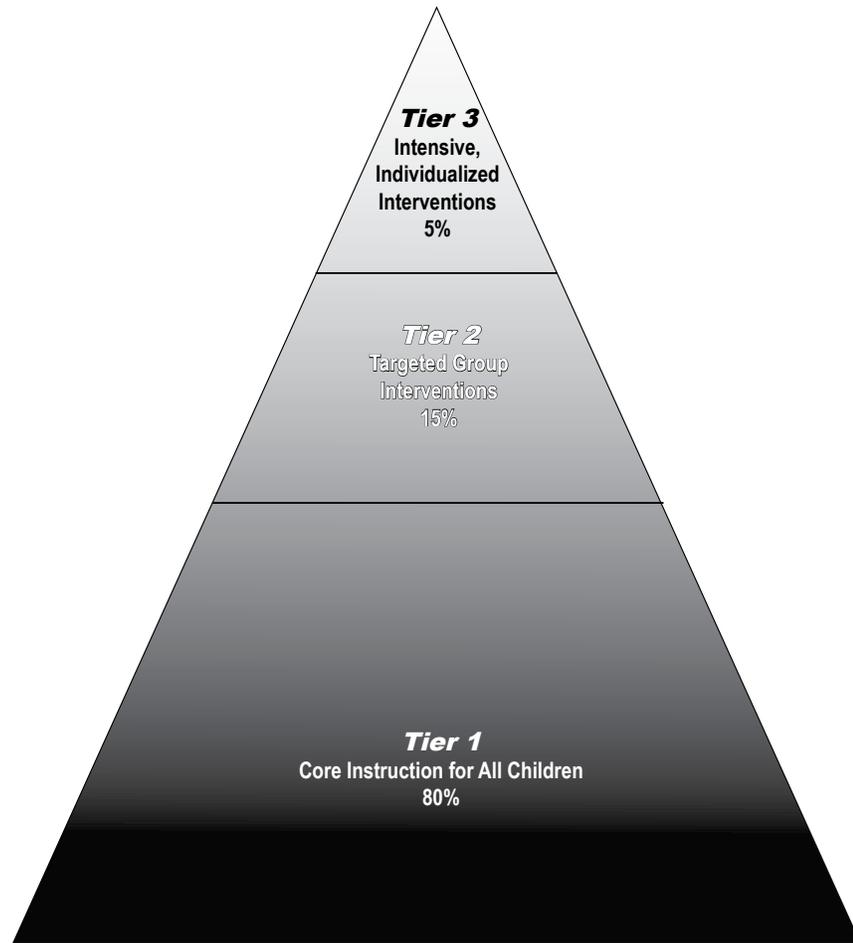
Adapted with permission from *The National Association of State Directors of Special Education,* 2005.

ipate that approximately 15% of the children will make adequate progress as a result of additional instructional support provided in Tier 2. In Tier 3, teachers implement intensive, individualized instruction for students who fail to make adequate progress in Tier 2. The RTI approach assumes that a small proportion of students (perhaps 5%) may continue to make insufficient progress even with the use of intensive individualized instruction. These students may have specific learning disabilities and should be referred for formal evaluation (Kamps & Greenwood, 2005; NASDSE, 2005; Reschly, 2005).

Other essential features of RTI include the collaboration between classroom teachers and specialists (i.e., the problem-solving process), the use of assessment data and continuous progress monitoring to inform instruction at each tier, research-based curriculum and instruction, and systematic assessment of the fidelity with which instruction and interventions are implemented (Fuchs & Fuchs, 2002: Fuchs, Fuchs, & Speece, 2002; Fuchs, Mock, Morgan, & Young, 2003; Kamps & Greenwood, 2005; NASDSE, 2005). Continuous progress monitoring of student performance is used to make data-based decisions across key dimen-

sions of teaching and learning that include: the effectiveness of the general education curriculum, the need to provide enhanced instruction for some students, and the timing and intensity of these interventions. By monitoring a student's learning and comparing it to that of peers receiving the same instruction, teachers can determine whether the student's academic level and rate of progress warrant further assessment or formal evaluation (Reschly, 2005).

Later in this document, it will become evident that most of the research-based instructional practices evaluated within RTI have been used primarily to address difficulties in reading, largely because this area represents the primary instructional need for the vast majority of children who have been identified with learning disabilities. Consequently, much less is known about the application of RTI to address children's learning problems in other academic areas or in behavior.

Prompted by the growing movement in the learning disabilities field to shift the focus away from the discrepancy model and toward early intervening combined with high quality instruction, the reauthorized IDEA included the RTI approach as one option that schools can use to identify students with learning disabilities. The new language in the legislation is as follows:

SEC.614. EVALUATION, ELIGIBILITY DETERMINATIONS, INDIVIDUALIZED EDUCATION PROGRAMS, AND EDUCATIONAL PLACEMENTS
"(b) EVALUATION PROCEDURES.—
(6) SPECIFIC LEARNING DISABILITIES. —
(A) IN GENERAL. —Notwithstanding section 607(b), when determining whether a child has a specific learning disability as defined in section 602 (29), a local educational agency shall not be required to take into consideration whether a child has a severe discrepancy between achievement and intellectual ability in oral expression, listening comprehension, written expression, basic reading skill, reading comprehension, mathematical calculation, or mathematical reasoning.
(B) ADDITIONAL AUTHORITY. —In determining whether a child has a specific learning disability, a local educational agency may use a process that determines if the child responds to scientific, research-based intervention as a part of the evaluation procedures described in paragraphs (2) and (3)."

Critical Contexts in the
Early Childhood Field

THIS SECTION presents several trends in the United States that have focused national attention on early education issues and helped to influence attitudes about the importance of services for very young children and their families: the emphasis on high quality early care and education, the school readiness movement, the national pre-kindergarten movement, and the importance of prevention and early intervention. Each of these trends represents important contextual factors that must be considered in developing an early intervening system for young children prior to kindergarten entry.

The Emphasis on High Quality Early Care and Education

The quality of early care and education has been at the forefront of research in the early childhood field for several decades. Mounting empirical evidence suggests that the quality of early childhood programs is an important determinant of children's social, language, and cognitive outcomes, as well as their school readiness skills (Bryant, Burchinal, Lau, & Sparling, 1994; Bryant, et al., 2003; Burchinal, Roberts, Nabors, & Bryant, 1996; Cost, Quality, & Outcomes Study Team, 1995; Howes, Phillips, & Whitebook, 1992; Lamb, 1997; Peisner-Feinberg, et al., 2001; Phillips, McCartney, & Scarr, 1987; Whitebook, Howes, & Phillips, 1989).

Conceptualized broadly, the definition of quality encompasses all aspects of children's surroundings, care, education, and experiences that are beneficial to their development and well-being. The features of high-quality programs cited most frequently include curriculum content and learning processes that cultivate school-related skills and knowledge, qualified teaching staff and supervisors, low teacher-child ratios and small class sizes, reflective teaching practices, intense and coherent programming, and collaborative relationships with parents (Love, Schochet, & Meckstrom, 1996; National Research Council, 2001; Phillipsen, Burchinal, Howes, & Cryer, 1997).

Program standards and practice guidelines identify the characteristics of programs and specific teaching practices that define high quality early childhood programs. Examples include the NAEYC Early Childhood Program Standards and Accreditation Criteria (NAEYC, 2005), the DEC Recommended Practices (Sandall, Hemmeter, Smith, & McLean, 2005), the Head Start Performance Standards and Head Start Child Outcomes Framework (revised in 1998).

As a part of a high quality program, early childhood teachers are expected to implement a curriculum that aligns with program and early learning standards and to make sound educational decisions for all children (NAEYC, NAECS/SDE, 2003). The proposed Rec-

ognition and Response system could enhance program quality by helping teachers identify significant concerns for individual children who may require more focused interventions, by offering them teaching strategies to address these individual needs, and by providing approaches for monitoring and evaluating the effectiveness of these instructional approaches.

The School Readiness Movement

In 1991, national attention was focused on school readiness through the establishment of six national education goals, with the first one being "All children in America will start school ready to learn" (National Education Goals Panel, 1991, codified in the Educate America Act, P.L. 103-277). Goal one was eventually defined as including the following dimensions of school readiness, which have become widely accepted in the early childhood field: physical and motor development, social and emotional development, approaches toward learning (e.g., creativity, initiative, attitudes, task mastery), language, cognition, and general knowledge (Kagan, Moore, & Bredekamp, 1995; Love, 2001; Meisels, 1999). In 1998, the National Education Goals Panel further defined school readiness by noting the need for *ready schools*—the notion that it was not sufficient for all children to be ready for school, but also that schools must be ready to meet the needs of all children.

Several recent publications have affirmed this earlier work, noting that, for example, children's readiness for school is made up of multiple components and shaped by many factors, including children's environments and early experiences (National Governors Association, 2005; Rhode Island KIDS COUNT, 2005; entire issue of The Future of Children, 2005, Vol. 15, No. 1). Other conclusions offered by these sources include: (1) experiences during the first five years of life provide the foundation for language, reasoning, problem-solving, social skills, behavioral and emotional health; (2) school readiness efforts must recognize that young children vary in their early experiences, skills, knowledge, language, culture, and family background and that gaps in school achievement among children from various groups already exist by the time they enter kindergarten; (3) families help prepare young children for school when they nurture, protect, and provide them with opportunities to learn and explore; and (4) schools improve readiness of young children by making connections with early care and education programs and by creating policies that promote smooth transitions to kindergarten.

The transition to kindergarten increasingly is viewed by early childhood experts as a key component of school readiness, largely because school entry is a critical time in children's development and a primary influence on their school careers (Pianta & Kraft-Sayre, 2003). The National Governor's Association (2005) recommended that local schools develop community-wide transition plans in collaboration with pre-kindergarten and kindergarten teachers, Head Start personnel, child care providers, administrators, parents, and community members.

Finally, policies that emphasize early literacy and children's academic preparation as key goals during pre-kindergarten appear to be changing the definition of school readiness. In 1998, for example, specific skills in the areas of language, literacy, and numeracy were

legislatively mandated to be part of the Head Start Child Outcomes Framework to enhance children's school readiness skills. The No Child Left Behind Act (NCLB) of 2001 includes provisions for an early literacy initiative—the Early Reading First Program—which targets low-income students in pre-kindergarten who are at risk of reading failure when then enter kindergarten. In conjunction with standards movement, the Good Start, Grow Smart initiative (http://www.whitehouse.gov/infocus/earlychildhood/toc.html) has prompted the creation of new state standards to align child outcomes with the curriculum and to assess children's school achievement in pre-k.

Early learning standards, guidelines, and interventions resulting from these policies likely will influence the way in which we monitor children's progress and evaluate program effectiveness in the future. It is conceivable, for example, that as early childhood programs address early learning standards related to literacy and other academic content areas, the number of young children who exhibit learning difficulties during pre-k may increase. This in turn could lead to an increased need for an early intervening system to ensure that all young children make a smooth transition to kindergarten and experience early school success.

The National Pre-Kindergarten Movement

Another important trend in the early childhood field in the U.S. is the movement to create public early education programs, with most states now offering some form of pre-k education to 4 year-olds (and some 3 year-olds). A recent study found that two-thirds of 4 year-olds and more than 30 percent of 3 year-olds were enrolled in a preschool education program in 2002, but that these programs had not reached all segments of the population equally, nor were these services distributed equally across various regions of the country (Barnett & Yarosz, 2004).

The Multi-State Study of Pre-Kindergarten found that 43 states offered pre-k in 2001, but it also reported considerable variability in the way in which pre-k programs were implemented by states on almost every dimension (e.g., age of children served, the focus on children at risk versus universal access, the location of programs, program standards, and costs; see Clifford, et al., 2005; Pianta, et al., 2005; and the entire issue of *Early Developments*, 2005, Vol. 9, No. 1).

With respect to the quality of public pre-k programs, the study found that the observed classroom quality was lower than what had been found in other large-scale studies of early childhood programs. This finding was somewhat surprising, given that pre-k program standards were high relative to other early childhood programs. The study also revealed that children enrolled in pre-k programs spent 44% of their time not engaged in any activity like pre-reading, language development, math, art, or social studies. Children spent the largest part of their day in routine, maintenance activities such as standing in line or eating.

How did the children enrolled in public pre-k programs fare? The Multi-State Pre-Kindergarten Study found that on both standardized measures of language and math and non-standardized measures (e.g., naming letters and numbers, counting, recognizing colors), chil-

dren made small but meaningful gains. The authors speculated that children's progress could have been greater if all programs had been of higher quality. They also recommended that the results be used to advocate for improved early education services and perhaps to consider a new model of school entry. Other early childhood experts have called for additional discussion about voluntary universal early learning programs compared to targeted services for those at greatest risk of poor achievement, and for clarification of standards for highly qualified teachers and standards for the kinds of development and learning that should take place in these programs (Barnett, Brown, & Shore; 2004; Shore, Bodrova, & Leong, 2004).

The Recognition and Response system is envisioned as beneficial for children enrolled in various types of early childhood programs (e.g., child care centers and homes, Head Start classrooms, private preschools, and state-funded pre-k programs). An opportunity for initial widespread implementation of this approach exists in early childhood settings that offer the highest professional and program standards. In addition, with its emphasis on research-based instruction and assessment as a foundation for supporting the learning of all children, the Recognition and Response system holds the potential to address recommendations to improve early childhood program quality.

The Importance of Prevention and Early Intervention

Policymakers recognized the fundamental importance of prevention and early intervention for our nation's most developmentally vulnerable young children with the passage of the Individuals with Disabilities Education Act in 1986 (reauthorized most recently in 2004). This landmark legislation established the Part C Infant-Toddler program, which required states to develop a comprehensive system of early intervention services for children birth to 3 years with developmental delays or disabilities and their families. States also were given the additional option of including infants and toddlers who were considered at risk of having developmental delays in the absence of early intervention services. The cornerstones of the Infant-Toddler program that have redefined health and human services for young children and families include its dual focus on health and development, the central role of the child's family as a key partner in all aspects service delivery, the emphasis on transition planning, and the need for interagency coordination (Meisels & Shonkoff, 2000).

IDEA also established the Part B-Section 619 Preschool Program, which required states to provide free and appropriate public education and related services for children 3 to 5 years with developmental delays or disabilities. Both programs require systematic efforts to create eligibility criteria, to find eligible children, to develop individualized approaches to intervention, and to provide appropriate services in natural or inclusive settings. However, definitions of developmental delays and disabilities in both programs cover broad areas of performance (e.g., physical disabilities, language delays, sensory impairments) and do not focus specifically on the identification of conditions that may place children at risk for having a learning disability.

As part of the reauthorization of IDEA (2004), a local education agency (LEA) is al-

lowed to use Part B funds to develop early intervening services for students in kindergarten through grade 12 (with an emphasis on students in kindergarten through grade 3) who have not been identified as needing special education or related services, but who need additional academic and behavioral support to succeed in a general education environment [see Section 613 (f)(1)]. The proposed Recognition and Response system constitutes a downward extension of the concepts contained within this new provision of IDEA, the goal of which is to help parents and teachers intervene as early as possible, when children first exhibit signs of learning difficulties. The proposed Recognition and Response system should be coordinated with existing prevention and early intervention services for children with disabilities (e.g., the Infant-Toddler and Preschool programs). By focusing on factors that place children at risk for learning disabilities prior to kindergarten, the proposed Recognition and Response system will extend and complement existing services for young children with disabilities.

Establishing an Evidence Base for the Recognition and Response System

The conceptual framework for the Recognition and Response system is being developed with grant support from the Emily Hall Tremaine Foundation (http://www.tremainefoundation.org) through a collaborative effort that involves the FPG Child Development Institute, the National Center for Learning Disabilities, the National Association for the Education of Young Children, the Communication Consortium Media Center, and key state partners. Collectively, these organizations and partners bring expertise in learning disabilities and early childhood education, as well as diverse perspectives from research, policy, and practice in both fields. The group was charged with the task of examining the evidence base for establishing an early intervening system that could be applied to early education settings and with building the components of the system in a way that addressed critical contexts and issues within the early childhood field.

The work is being accomplished through two primary activities: (1) a comprehensive review of the literature to produce a research synthesis on RTI which serves as the empirical basis for early intervening system in the early childhood field; and (2) a series of discussions with the collaborating organizations and state partners to develop a conceptual framework for the Recognition and Response system adapted from the RTI model. A third activity, evaluating the implementation and effects of Recognition and Response, represents an important future goal of this initiative.

Method

Search strategy

SEARCH TERMS. The search of the literature was conducted to identify both conceptual and empirical articles related to RTI; however, only the empirical studies investigating the efficacy of RTI were included in the research synthesis. The conceptual articles were used to provide background information and describe the theoretical and conceptual underpinnings of RTI. Articles were identified by conducting searches through several online databases. The following keywords were used during these searches: early identification, learning disabilities/difficulties, responsiveness/response-to-instruction/intervention/treatment, and early intervention.

SOURCES. Searches were conducted in the following databases: ERIC, EducationFullText, and PsychLit. Journal issues focusing on RTI were also searched for relevant articles (see *Learning Disabilities Research and Practice*, 2003, Vol. 18, No. 3; *Learning Disabilities Quarterly*, 2005, Vol. 25, No. 1; and *Journal of Learning Disabilities*, 2005, Vol. 28, No. 6). In conjunction with a national validation of the research synthesis, reviewers were asked to identify any additional articles for inclusion in the paper. Two additional studies were identified for inclusion through this process.

SELECTION CRITERIA. The three criteria used to determine the inclusion of studies were:
1. *Age of subjects.* The study included children ages 4-8 years. The upper limit for inclusion in the synthesis was third grade.
2. *Nature of disability.* The study included children characterized as nonresponders, at risk for learning disabilities/difficulties, or as having math and/or reading disabilities.
3. *Intervention.* The study included at least one of the three components of RTI: (1) the use of multiple tiers of intervention, with increasingly intense interventions that guide its implementation; (2) a problem-solving or standard treatment protocol approach used to identify and provide supplemental instruction to children who were not responsive to general classroom instruction, or to identify the characteristics of these children; and (3) an integrated data collection/assessment system to guide decision-making for identification purposes and/or instructional supports.

ARTICLES SELECTED FOR REVIEW. A total of 14 empirical studies met the three criteria for inclusion in the review and served as the current research base regarding the efficacy of RTI. A detailed summary of the empirical studies can be found in Appendix A.

Development of abstracts

Abstracts for the 14 empirical studies were developed to provide (1) a summary of the existing efficacy research on RTI and (2) a framework from which the empirical studies could be analyzed for overall quality. The structure for the development of the abstracts was guided by recommendations outlined by the National Research Council's (2005) *Advancing Scientific Research in Education* (see Table 1 for recommended components of abstracts of empirical studies). Table 2 describes the process of developing the abstracts of studies included in the review.

Table 1. Components of Empirical Articles Template

1. Background/context
2. Purpose of the study
3. Setting
4. Population/participants
5. Intervention/program/practice
6. Research design
7. Data collection and analysis
8. Findings and results
9. Conclusions/recommendations

Table 2. Steps in the Development of Templates.

1. A template for empirical articles was developed by the research team
   (see Appendix B for template).
2. Individual members of the research team read and abstracted conceptual and empirical articles.
3. Abstracts were read and reviewed by other members of the research team for accuracy of information.
4. Empirical abstracts were reviewed by at least two members of the research team for quality of the research design.
5. Abstracts were stored in a central digital repository at the FPG Child Development Institute.

Analysis procedures

The first step involved the creation of summary tables for use in analyzing information from the empirical studies (see Appendix A). The next step involved the development of a quality indicators rating scale to evaluate the quality of experimental and quasi-experimental research designs (see Appendix C for rating scale). The third step involved the evaluation of the quality of the research design in each study.

Research design

Appendix A provides a summary of the research designs across studies. Most studies employed either experimental or quasi-experimental designs; however, three studies were classified as causal-comparative, one employed a regression discontinuity research design, and one used a combined experimental/causal-comparative research design. Table 3 provides a list of the study designs.

Table 3. Research Designs of Empirical Articles

Research Design	Number of Empirical Articles
Experimental	7
Quasi-experimental	2
Causal-comparative[A]	4
Combination experimental/causal comparative	1
Regression discontinuity[B]	1

[A] Causal comparative research designs refer to designs in which participants are assigned to groups according to predetermined criteria following the implementation of an intervention.

[B] Regression discontinuity research designs refer to designs in which participants are assigned to groups according to predetermined criteria (e.g., using pretest measures) prior to the implementation of an intervention.

Development of quality indicators rating scale

A rating scale was developed to measure the quality of the research conducted on RTI. Criteria outlined in *Exceptional Children*'s special issue (Volume 71, Number 3, Winter 2005) on evidence-based practice in special education served as the basis for the development of the rating scale (see Gersten, et al., 2005). In this article, the authors describe both essential and desirable indicators; all of which were included in the quality rating scale developed for this synthesis.

Specifically, a rating scale was developed for studies that employed experimental/quasi-experimental research designs, which represented the primary research design identified through the formulation of the abstracts. Although other research designs were identified for a small number of studies during the development of the abstracts (see Table 3), the research team determined that the rating scale developed for experimental/quasi-experimental designs could be used to evaluate the quality of the research in these cases.

The criteria outlined in the *Exceptional Children* issue were adapted by applying a 4-point Likert scale, which enabled the research team to rate specific items as *adequate* (4), *partial* (3), *inadequate* (2), *unknown* (1), or *not applicable* (N/A). Through the use of this scale, the research team could assess the extent to which each quality indicator had been addressed by a particular research study rather than simply evaluating whether an indicator was present or not.

Evaluation of the empirical studies

To evaluate the research base regarding RTI, two members of the research team used the rating scale to assess each empirical article. Both researchers evaluated all of the studies (n = 14). The scores assigned by the researchers for each study were then compared for reliability purposes. Consensus was achieved for all studies, even in cases where reliability was 80% or greater. Overall interrater reliability ranged from 62% to 100%, with a mean of 87%.

QUALITY RATINGS FOR EMPIRICAL STUDIES. The overall score for the 14 empirical studies (M = 3.15, SD = 0.66) demonstrated that the research articles were of good quality. Items that were rated as adequate were most often related to providing information about whether participants demonstrated the difficulties/disabilities presented (essential) (M = 3.93, SD = 0.28),

measurement of outcomes (essential) (M = 3.93, SD = 0.28), data analysis techniques used (essential) (M = 4.00, SD = 0.00), and presentation of results (desirable) (M = 4.00, SD = 0.00).

However, the studies were particularly weak in providing comparable attrition rates across samples (desirable) (M = 2.30, SD = 1.37), describing audio- or videotape techniques to capture the implementation of the interventions (desirable) (M = 2.50, SD = 1.57), collection of maintenance data beyond an immediate posttest (desirable) (M = 1.86, SD = 1.41), and providing criterion and construct validity of the measures used (desirable) (M = 1.67, SD = 1.07). The mean scores across studies for the individual items on the quality indicators rating scale can be found in the Appendix D.

Search Results

Characteristics of study participants

Table 4 summarizes the background information regarding the participants, including the sample size, ages of the participants, race/ethnicity, and criteria for inclusion. Sample sizes ranged from 36 to 273 across studies, with a mean of 116 children.

Across the studies, 1,627 children in kindergarten through 3rd grade participated. The majority of the children were enrolled in first, second, and third grades.

Table 4. Selected Characteristics Of Study Participants

Study	Sample Size	Grade	Race/ethnicity	Criteria
Burns & Senesac (2005)	146	1, 2, 3	Majority Caucasian	Below 25th percentile in reading
Case, Speece, & Molloy (2003)	36	1, 2	Primarily minority	At risk for reading disability
Coyne, et al. (2004)	59	1	Majority Caucasian	At risk
Fuchs, et al. (2005)	127	1	Primarily Caucasian	At risk for math disability
Fuchs, Fuchs, & Prentice (2004)	201	3	Primarily African American	At risk for math and/or reading disability
McMaster, et al. (2005)	56	1	Unknown	Nonresponders
O'Connor (2000)	146	K, 1, 2	Primarily African American	Attention problems/ learning disabilities
O'Connor, Harty, & Fulmer (2005)	37	K, 1, 2, 3	Primarily European American	At risk for reading difficulties
O'Connor, et al. (2005)	103	K, 1, 2, 3	Primarily Caucasian	At risk for reading difficulties
Speece & Case (2001)	273	1, 2	Majority Caucasian	At risk for reading failure
Torgesen & Davis (1996)	100	K	Primarily African American	Below 80th percentile on measure of phonological awareness
Torgesen, et al. (1999)	180	K, 1, 2	Slight majority of minority	Lowest combined score on letter naming and phoneme elision tasks
Vaughn, Linan-Thompson, & Hickman (2003)	45	2	Majority Hispanic/ Latino	At risk
Vellutino, et al. (1996)	118	1, 2	Unknown	Poor readers

Three of the studies included children who were performing below expectation in one or more areas (Burns & Senesac, 2005; Torgesen & Davis, 1996; Torgesen, et al., 1999). Nine

additional studies focused on children at risk for academic failure in one or more areas (e.g., math, reading) (Case, Speece, & Molloy, 2003; Coyne, et al., 2004; Fuchs, Fuchs, & Prentice, 2004; Fuchs, et al., 2005; O'Connor, 2000; O'Connor, Harty, & Fulmer, 2005; O'Connor, Harty, Fulmer, & Bell, 2005; Speece & Case, 2001; Vaughn, Linan-Thompson, & Hickman, 2003). Students in the remaining studies were characterized as being poor readers (Vellutino, et al., 1996), or being nonresponsive to otherwise effective instruction (McMaster, et al., 2005).

Description of multi-tier approach

Appendix E contains a description of the implementation of the multi-tier approach to identification and intervention used in each of the studies. Because a number of studies did not explicitly state which tiers were implemented, it was necessary for the research team to make inferences about the specific tiers that were used in these cases. Each of the studies in this research synthesis was described based upon the three-tier approach discussed earlier in this document.

Two of the studies focused primarily on the use of Tier 1, with an emphasis on issues related to identification. In these studies, the researchers examined (1) the validity of the dual–discrepancy approach (i.e., the use of various identification criteria, dual discrepancy identification versus IQ reading achievement discrepancy; (Burns & Senesac, 2005; Speece & Case, 2001).

Eight of the studies used Tier 1 (identification) in combination with Tier 2 (e.g., differentiated instruction, curriculum modifications) with respect to the implementation of RTI (Case, Speece, & Molloy, 2003; Coyne, et al., 2004; Fuchs, Fuchs, & Prentice, 2004; Fuchs, et al., 2005; McMaster, et al., 2005; O'Connor, et al., 2005; Torgesen & Davis, 1996; Vaughn, Linan-Thompson, & Hickman, 2003). In these studies, researchers implemented various aspects of RTI (e.g., screening, differentiated instruction); however, none of them implemented all three tiers. For example, the majority of the studies used some type of screening process (e.g., curriculum-based measures, standardized assessment), which led to the identification of children who were characterized as nonresponders, learning disabled, or at risk for academic failure in one or more content areas (see Appendix E for complete information about the multi-tier approach across studies).

Upon completion of this identification process, students then were provided with some type of specialized intervention (e.g., curriculum modifications, differentiated instruction); however, the efficacy of the multi-tier approach to identification and intervention was not the primary focus of the study. For example, one study analyzed predictors of responsiveness to intervention (Torgesen & Davis, 1996). Other studies addressed the effects of specific interventions on the development of children who were reported to be non-responsive to general classroom instruction. The interventions in these studies ranged from mathematical problem-solving to phonological instruction (Fuchs, Fuchs, & Prentice, 2004; Fuchs et al., 2005; Vaughn, Linan-Thompson, & Hickman, 2003; O'Connor et al., 2005). The remaining studies focused on

topics such as (1) determining factors that mediate beginning reading instruction and (2) examining the validity of the dual discrepancy approach to identification commonly used in RTI (Case, Speece, & Molloy, 2003; Coyne, et al., 2004).

Further examination of the studies revealed that several did not follow the tiers of RTI sequentially as a hierarchy of intervention (i.e., Tier 1, Tier 2, Tier 3). For instance, two studies went directly from Tier 1 (identification) to Tier 3 (individualized interventions) (Torgesen, et al., 1999; Vellutino et al., 1996). Another study identified children through a Tier 1 screening process and then randomly assigned children to either a Tier 2 (peer-mediated small groups) or Tier 3 intervention (individualized intervention) (McMaster, et al., 2005), whereas only Tiers 2 and 3 were examined in another study (O'Connor, Harty, & Fulmer, 2005).

An additional study implemented the multi-tiered approach by moving students from Tier 1 to Tier 3 and then back to Tier 2 (O'Connor, 2000). This study looked at the effects of a layered approach to intervention; however, the tiers were not implemented sequentially. None of the studies directly assessed the effects of a complete intervention hierarchy implemented in sequential order.

Other characteristics of interventions

STANDARD TREATMENT PROTOCOL VERSUS PROBLEM-SOLVING APPROACH. The studies were analyzed to determine whether a standard treatment protocol or problem-solving approach was used as the primary means for making decisions about the interventions. In the majority of the studies, a standard treatment protocol was used in which an empirically validated treatment was implemented for all targeted children (see Appendix E). One study (Case, Speece, & Molloy, 2003) used a problem-solving approach in which a collaborative consultation model was used to determine interventions for individual children; however, the focus of this study was on identification rather than the efficacy of the problem-solving approach used. Another study employed a combination of a standard treatment protocol and problem-solving approach in which a standard treatment protocol was tailored to individual children's needs (Vellutino, et al., 1996).

CONTENT OF INTERVENTION. The studies were then analyzed to determine the content of the interventions used across studies (see Appendix A for a complete description of the characteristics of the interventions across studies). In nine of the studies, language and literacy-based skills were the primary focus of the interventions (Coyne, et al., 2004; McMaster, et al., 2005; O'Connor, 2000; O'Connor, Harty, & Fulmer, 2005; O'Connor, et al., 2005; Torgesen & Davis, 1996; Torgesen et al., 1999; Vellutino et al., 1996; Vaughn, Linan-Thompson, & Hickman, 2003). The content of the interventions included classroom reading instruction, phonological awareness instruction, peer-mediated strategies, one-to-one blending, explicit instruction in the alphabetic principle, and reading with fluency. Two additional studies focused on math interventions delivered either in a whole-class format or through small group tutoring (Fuchs, Fuchs, & Prentice, 2004; Fuchs, et al., 2005). The remaining studies did not deliver an intervention; instead, they

focused explicitly on identification in Tier 1.

DELIVERY AND DURATION OF INTERVENTIONS. The individuals delivering the interventions across all studies included the lead researchers, other members of the research team, and teachers; however, in most of the studies, researchers were responsible for collecting assessment data and determining which children were nonresponsive to regular classroom instruction. The duration of the interventions in the studies ranged from twelve weeks to four years (in the case of O'Connor et al., 2005).

Assessing student progress and outcomes

Information about assessment methods and outcome variables is summarized to address the following issues: (1) when the outcome and progress monitoring measures were administered (e.g., pretest/posttest, multiple data points), (2) what types of measures were administered (e.g., standardized measures, observation instruments), and (3) what academic or behavioral outcomes were assessed (e.g., phonological awareness, decoding). A summary of the student measures used across studies can be found in Appendix A.

TIMING OF ASSESSMENT FOR OUTCOMES. With respect to when the outcome measures were administered, four of the studies employed a pretest/posttest methodology (Burns & Senesac, 2005; Coyne, et al., 2004; Fuchs, Fuchs, & Prentice, 2004; Torgesen & Davis, 1996), whereas the remaining studies used a combination of pretest/posttest and progress monitoring at regular intervals (ranging from biweekly to three times per year) (Case, Speece, & Molloy, 2003; McMaster et al., 2005; O'Connor, 2000; O'Connor, Harty, & Fulmer, 2005; O'Connor et al., 2005; Speece & Case, 2001; Torgesen et al., 1999; Vaughn, Linan-Thompson, & Hickman, 2003; Vellutino et al., 1996).

ACADEMIC AND BEHAVIORAL OUTCOMES ASSESSED. Improvements or changes in reading/language skills, including rapid naming, phonological processing, and vocabulary were assessed in the majority of the studies (Burns & Senesac, 2005; Case, Speece, & Molloy, 2003; Coyne et al., 2004; McMaster et al., 2005; O'Connor, 2000; O'Connor, Harty, & Fulmer, 2005; O'Connor, et al., 2005; Speece & Case, 2001; Torgesen & Davis, 1996; Torgesen, et al., 1999; Vaughn, Linan-Thompson, & Hickman, 2003; Vellutino et al., 1996). Four of the studies included measures of cognitive functioning or intelligence (Case, Speece, & Molloy, 2003; Fuchs, et al., 2005; Speece & Case, 2001; Vellutino et al., 1996). Only four of the studies included mathematical and/or neuropsychological measures (Fuchs, Fuchs, & Prentice, 2004; Fuchs, et al., 2005; Torgesen et al., 1999; Vellutino, et al., 1996). Other studies included classroom observation measures of behavior (e.g., behavior problems, attention, social skills), parent questionnaires, results from state assessments, and teacher interviews/rating scales (Case, Speece, & Molloy, 2003; Fuchs, Fuchs, & Prentice, 2004; Fuchs et al., 2005; Speece & Case, 2001; Torgesen et al., 1999; Vaughn, Linan-Thompson, & Hickman, 2003).

METHODS OF PROGRESS MONITORING. With respect to the types of measures, the majority of the measures used for pretest/posttest purposes consisted of standardized assessments.

In five of the studies, curriculum-based measurement (CBM) was the primary method of monitoring student progress. Both rate and level of growth were monitored as a means of determining a student's response to instruction (i.e., the dual-discrepancy model) (Case, Speece, & Molloy, 2003; Fuchs et al., 2005; McMaster et al., 2005; Speece & Case, 2001; Vaughn, Linan-Thompson, & Hickman, 2003). In five other studies, however, progress was monitored through the use of standardized assessments or with measures developed for the current or previous studies (O'Connor, 2000; O'Connor, Harty, & Fulmer, 2005; O'Connor, et al., 2005; Torgesen et al., 1999; Vellutino et al., 1996). Only one study conducted periodic classroom observations to evaluate the quality of general instruction being implemented in the classrooms (Case, Speece, & Molloy, 2003).

EFFECT SIZES REPORTED. Ten of the studies reported effect size calculations in addition to inferential statistics in relation to the effectiveness of the interventions. The effect sizes ranged from -0.81 to 6.06 (see Table 5 for the range of effect sizes reported for each study).

Table 5. Reported Effect Sizes

Study	Independent variable	Range of effect sizes
Vellutino, et al. (1996)	1:1 reading tutoring	Numerous effect sizes reported
Speece & Case (2001)	Classification scheme	-0.81 - 0.21
Case, Speece, & Molloy (2003)	Classification scheme	-0.04 – 2.89
Vaughn, Linan-Thompson, & Hickman (2003)	Reading intervention	0.47 – 6.06
Fuchs, Fuchs, & Prentice (2004)	Two math interventions	0.39 – 2.45
Burns & Senesac (2005)	Four DD approaches to identification	0.51 – 0.69
Fuchs, et al. (2005)	Math intervention	-0.08 – 2.04
McMaster, et al. (2005)	Three reading interventions	0.15 – 1.29
O'Connor, Harty, & Fulmer (2005)	Tiers of intervention	0.40 – 1.40
O'Connor, et al. (2005)	Tiers of intervention	0.09 – 0.52

IMPLEMENTATION FIDELITY. Twelve of the studies focused on the use of an intervention for the purposes of remediation and prevention. All of these studies provided detailed descriptions of the components of the intervention, and nine studies included implementation fidelity measures (Case, Speece, & Molloy, 2003; Coyne et al., 2004; Fuchs, Fuchs, & Prentice, 2004; Fuchs, et al., 2005; McMaster et al., 2005; O'Connor, et al., 2005; Torgesen, et al., 1999; Vaughn, Linan-Thompson, & Hickman, 2003; Vellutino et al., 1996). In one of the studies, however, fidelity of implementation was not relevant because the causal-comparative design did not involve delivering an intervention (Case, Speece, & Molloy, 2003). The absence of implementation fidelity in the other three studies makes it difficult to determine the validity of the intervention models because little information was provided about whether or not the interventions were implemented as intended.

Synthesis Findings and Conclusions

The findings from this research synthesis indicate that there is an emerging body of empirical evidence to support claims that RTI is an effective method for identifying children at risk

for learning difficulties and for providing specialized interventions either to ameliorate or to prevent the occurrence of learning disabilities. There was considerable variability, however, across studies in how RTI was defined, implemented, and evaluated, which limits the findings. Although there was general agreement across studies about the conceptualization of RTI in terms of its key components and tiered implementation, there was very little agreement about the specific assessment or data monitoring procedures, the nature and focus of specialized intervention strategies, who delivered the interventions, the duration and intensity of the interventions, and benchmarks used for determining when a new phase should be initiated for individual children.

As an intervention, and across all studies, RTI varied on a number of dimensions that included (1) the functions of RTI (e.g., assessing factors that mediate reading achievement, comparing a dual-discrepancy model with IQ-reading achievement, assessing the tiered approach to assessment and intervention); (2) the individuals delivering the interventions (e.g., members of the research team, teachers); (3) the length of time children participated in the intervention (i.e., from twelve weeks to four years) and likely the duration of the sessions (although this information was not reported in the majority of studies); (4) what type of intervention approach was used (standard treatment protocol versus problem-solving); and (5) outcome measures used. It is noteworthy that only one study (Case, Speece, & Molloy, 2003) included an assessment of the quality of the general education curriculum and instruction, a defining feature of RTI used to determine whether the majority of students are achieving benchmarks in learning and behavior in Tier 1 prior to implementing differentiated instruction.

The studies also differed in their implementation of the multi-tier approach. Although the majority of studies used multiple tiers of intervention, the focus of these studies remained on the effects of a specific intervention or interventions within the context of a tiered model of intervention. The vast majority of studies assessed the effects of a particular intervention, focused on improving student outcomes, that was independent of the tiered RTI approach. Two studies (McMaster et al., 2005; O'Connor, 2000) implemented an RTI model using all three tiers; however, the tiers were not implemented sequentially. Furthermore, the focus of one of the studies (McMaster, 2005) was on the effects of the interventions rather than the multi-tier approach. None of the studies directly assessed the effectiveness of implementing a three-tier approach to assessment and intervention (another defining feature of RTI). Additional research is needed to understand which features contribute to the efficacy of RTI in practice.

The research synthesis also found that the majority of studies included school-age children as study participants (primarily in grades 1 to 3), which leaves unanswered questions about how an RTI model could be implemented effectively in early education settings that enroll 3- and 4-year-olds. Some research (Coyne et al., 2004; Torgesen & Davis, 1996) provides preliminary evidence that kindergarteners who are at risk for learning difficulties

can catch up by first grade, if provided the appropriate supports in kindergarten. Moreover, the findings from these studies indicate that gains made by these children were maintained through the first part of first grade. Other research (O'Connor, 2000; O'Connor, Harty, & Fulmer, 2005; O'Connor, et al., 2005) supports the use of a multi-tier approach prior to first grade as well. However, these latter studies were implemented over a four-year period beginning in kindergarten; thus, the findings do not reflect the direct benefits of using RTI prior to first grade. Despite this, the findings from these studies indicate that the later incidence of placement in special education decreased as a result of taking part in an RTI model starting in kindergarten. The findings from these studies suggest that intervening in kindergarten, and possibly earlier, is a promising practice that could produce positive outcomes for young children who are at risk for learning difficulties in primary school.

Finally, the primary focus for intervention in a majority of the studies was language and literacy, with a particular emphasis on phonological awareness. Far less is known about the applicability of RTI for children who experience difficulties in other domains, such as math, social-emotional development, behavior, and for other precursors of learning disabilities that have been identified in the literature for younger children, including language delays, attention, and self-regulation difficulties (Lowenthal, 1998; McCardle, Scarborough, & Catts, 2001).

In conclusion, the research synthesis findings suggest that RTI is a promising approach, particularly because of its focus on sound instructional principles, such as effectively teaching all children, intervening early, using research-based interventions and instruction, monitoring student progress, and using assessment data to inform instructional decision-making (NASDSE, 2005). Further research is needed to understand the unique contributions of each of these elements of RTI as well as how these elements constitute an intervention package.

A Conceptual Framework for the Recognition and Response System

IT IS A FUNDAMENTAL TENET OF EARLY INTERVENTION that the earlier we intervene, the more impact we likely will have on ameliorating the potential negative consequences of disabilities on child and family outcomes (Dunst, 2000; Guralnick, 1998; Shonkoff & Phillips, 2000; Wolery & Bailey, 2002). It is logical then to assume that the earlier we intervene with children who may be at risk for learning disabilities, the more likely we will be to support their subsequent development and learning and prevent learning difficulties from occurring later.

On the basis of what is known about RTI for school-age children as described earlier in this document, an early intervening system called Recognition and Response is being developed and validated for use with younger children (i.e., 3 to 5 year-olds) enrolled in various types of early education settings. Recognition refers to the methods used to identify young children who exhibit early learning difficulties and who may be at risk for learning disabilities when they are older. Response refers both to the ways in which teachers and parents respond to young children with learning difficulties as well as to the ways in which young children react to specific interventions.

Some elements of the RTI model, such as a problem-solving process to solve practice dilemmas (Ostrosky & Chetham, 2005) or an intervention hierarchy to address children's social-emotional development (Brown, Odom, & Conroy, 2001), have been described previously in the early childhood literature. For example, a teaching pyramid has been proposed to help early childhood teachers identify social and emotional teaching strategies along a continuum from building positive relationships with children and adults to implementing individualized child-focused interventions (Fox, Dunlap, Hemmeter, & Strain, 2003). The proposed Recognition and Response system builds on this earlier work in important ways by (a) focusing on helping teachers support children's academic learning and development as well as their social-emotional development and (b) incorporating other essential elements from the RTI model (e.g., linking screening, assessment and progress monitoring with research-based curriculum, instruction, and interventions; using a collaborative problem-solving model) into a single early intervening system.

The Recognition and Response system is based on the premise that parents and teachers can learn to recognize critical early warning signs that a young child may not be learning in an expected manner and to respond in ways that positively affect a child's early school success. A number of features of the proposed Recognition and Response system make it

a developmentally appropriate approach for use with children as young as 3 or 4 years of age. For example, there is limited reliance in the proposed system on formal diagnosis and labeling. Instead, the Recognition and Response system emphasizes a systematic approach to responding to early learning difficulties that includes assessing the overall quality of early learning experiences for all children, as well as making program modifications, tailoring instructional strategies, and providing appropriate supports for individual children who struggle to learn. These practices reflect sound early education principles for all young children and are not limited to those who require additional supports. Table 6 illustrates how the core principles of RTI (NASDSE, 2005) relate to core early childhood beliefs and practices in conjunction with the proposed Recognition and Response system. It is important that new practices being established for the early childhood field are anchored in existing practices such as RTI, which is supported by an emerging body of empirical evidence and by growing consensus from the education field. At the same time, in its conceptualization of an early intervening system that is tailored to the unique needs of very young children, the early childhood field can offer important contributions that include an emphasis on collaborating with parents and specialists, planning for transitions, and supporting systemic change.

Table 6. Core Principles of RTI and Core Early Childhood Beliefs and Practices

*Core Principles of RTI	**Core Early Childhood Beliefs and Practices
We can effectively teach all children.	We can teach children with diverse cultural, linguistic, and learning characteristics.
Intervene early.	Intervene early.
Use a multi-tiered model of service delivery.	Use an intervention hierarchy.
Use a problem-solving method to make decisions within a multi-tiered model.	Use a systematic, collaborative approach in partnership with parents and specialists to address concerns about individual children.
Use research-based, scientifically validated interventions/instruction, to the extent available.	Use early education practices that are based on the best available research evidence combined with the field's collective wisdom and values.
Monitor student progress to inform instruction.	Determine whether children are making progress as expected and use this information to make practice decisions.
Use data to make decisions.	Use information from assessments to make practice decisions.
Use assessment findings to identify children who are not progressing at expected rates, to determine what children can and cannot do in academic and behavioral domains, and to monitor progress to determine intervention effectiveness.	Gather information about children using multiple methods and sources (including parents) and interpret this information to evaluate teaching practices and child progress.

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Essential Components of the Recognition and Response System

Figure 2 shows the four essential components of the proposed Recognition and Response system: (1) an intervention hierarchy; (2) screening, assessment, and progress monitoring; (3) research-based curriculum, instruction, and focused interventions; and (4) a collaborative problem-solving process for decision-making. This document offers only a brief description of each of these components. Future efforts should focus on further developing and evaluating each component as part of an integrated system, particularly with respect to identifying the specific assessment and instructional strategies within each of the tiers of the intervention hierarchy.

Figure 2
Recognition and Response System for Early Intervening
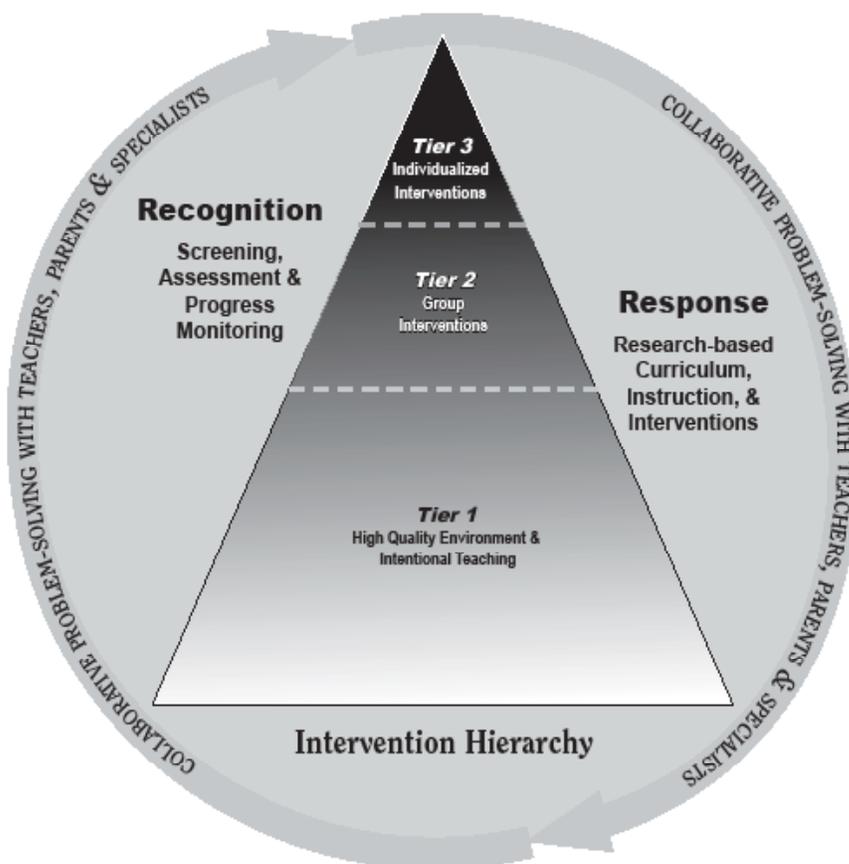
Intervention hierarchy

An intervention hierarchy reflects increasing levels of intensity of instruction and intervention that correspond directly to children's needs for support. A teacher's decision to move

from one tier to the next is guided by screening and assessment information as part of a systematic and collaborative problem-solving process that includes parents and specialists. The supports provided to individual children and groups of children are grounded in research-based curriculum and instructional practices, to the extent that this is possible.

TIER 1. In Tier 1, a research-based curriculum and effective intentional teaching strategies are provided for all children. The curriculum and instruction are aligned with early learning standards and benchmarks and reflect recommended early childhood practices. Universal screening, assessment, and progress monitoring are conducted in key academic, health, and developmental areas to (a) determine whether most children are learning in an expected manner and (b) identify children who need additional supports (see NAEYC Assessment of Child Progress, 2005). If most children (approximately 80%) make adequate progress, it can be assumed that the general early education curriculum is of sufficient quality. Children who do not make adequate progress in Tier 1 will require focused intervention at Tier 2.

TIER 2. In Tier 2, teachers provide interventions and curriculum modifications that require minimum adjustments to classroom routines to targeted groups of children who do not make adequate progress in Tier 1. Group interventions, such as introducing vocabulary prior to storybook reading or providing visual cues during circle time, can be developed through a problem-solving process in collaboration with parents and specialists. As in Tier 1, practice decisions are guided by assessments (e.g., progress monitoring, curriculum-based checklists) and rely on research-based or recommended practices.

TIER 3. In Tier 3, early educators implement more intensive and individualized instruction for children who do not make adequate progress in Tier 2. Examples of Tier 3 interventions would be the teacher working individually with a child to reinforce rhyming concepts or helping a child learn to write her name. As is the case in Tier 2, instructional decisions are developed through a collaborative problem-solving process and guided by assessments and research-based or recommended practices. Children who do not make adequate progress in Tier 3 may need to be referred for formal evaluation of learning disabilities or other special needs.

Screening, assessment, and progress monitoring

An integrated assessment system helps early childhood teachers accomplish the following three goals: (1) make informed instructional decisions; (2) identify strengths, interests, or areas of concern that require focused interventions for individual children; and (3) improve early education programs and interventions (NAEYC, 2005; NAEYC/SDE, 2003; Sandall, Hemmeter, Smith, & McLean, 2005). An integrated assessment plan includes multiple methods and sources of information for each child (with sensitivity to the cultural contexts in which children develop), as well as classroom summary profiles. It is important to communicate assessment information with parents in a timely, sensitive manner and to engage parents in making contributions to the assessment process and to the interpretation of the results. In

the description of the tiers that follows, it should be noted that if the need for formal diagnostic assessments is determined for a child at any point during the problem-solving process within any tier, these assessments should be completed by qualified personnel in a timely manner. In Tier 1, timely, comprehensive screening aligned with early learning standards and benchmarks should occur for all children within three months of their entering the program (NAEYC, 2005). The results of ongoing screening and progress monitoring methods (e.g., observation, checklists, rating scales, work sampling, curriculum-based assessments) can be used to determine which children are meeting key benchmarks, which children are in the process of developing these skills, and which children are not making adequate progress (see NAEYC Early Childhood Program Standard 4, NAEYC, 2005). In Tier 2, formal and informal assessments used in Tier 1 focus more closely on areas of concern (e.g., phonological awareness, concepts of print, basic math concepts) for children who do not make adequate progress in Tier 1. In Tier 3, it may be necessary to use norm-referenced and standardized diagnostic tests, primarily in consultation with parents and early childhood specialists, in seeking information on children's eligibility for special education services. Formal assessments are used in conjunction with informal assessments, such as work sampling, as a way to continue monitoring children's progress and responses to interventions.

Research-Based Curriculum, Instruction, and Focused Interventions

Providing a research-based curriculum and effective intentional teaching will help to ensure that the majority of children in the class demonstrate growth and development across all domains. The overarching goal of the Recognition and Response system is for teachers to use assessment as part of an integrated instructional system to make improvements in the general early education program and to plan more focused interventions for children who may be at risk for learning disabilities and who require additional supports. Future efforts should focus on identifying standard research-based interventions that would comprise a toolkit from which teachers could extract specific practices (e.g., curriculum modifications, environmental arrangements, peer-mediated strategies, individualized instruction) to respond to individual learning characteristics within each tier of an intervention hierarchy.

Collaborative Problem-Solving Process for Decision-Making

To make decisions about when to move from one tier to the next or to select particular assessment or intervention strategies for individual children, teachers should rely on the problem-solving process. The problem-solving process occurs in all three tiers of the intervention hierarchy and involves (a) defining the problem, (b) analyzing the problem, (c) developing a plan, and (d) evaluating the plan to determine whether it was effective in addressing specific

goals (Bergan & Kratochwill, 1990). Key to the problem-solving process is the use of data to inform decisions, thus creating a dynamic link between "recognition" and "response" that reflects the changing needs of young children. The problem-solving process is collaborative, systematic, and used by teachers, parents, and specialists to make decisions about practice and to evaluate their effectiveness for individual children. This process also should provide transition-to-kindergarten supports through a careful planning process that includes input from all relevant stakeholders (Dockett & Perry, 2001; Pianta, et al., 2001). As an essential component of the transition planning process for individual children, a learner profile could be used to facilitate information-sharing among key stakeholders regarding a child's learning characteristics, progress monitoring information, and focused interventions that have been implemented and evaluated. Collaborative problem-solving will require that parents, educators, specialists, and administrators work together to determine appropriate resources and supports as well as specific information-sharing practices that facilitate parental engagement in the Recognition and Response system. A particular emphasis should be placed on the specific needs of culturally- and linguistically-diverse and low-income families to ensure their full participation and engagement in the Recognition and Response system.

Support for Systemic Change

To ensure widespread adoption and implementation of the Recognition and Response system, it is necessary to create an infrastructure with enough capacity to sustain organizational changes that are made. Included in systemic change are: professional development to ensure that the knowledge and skills needed to implement the changes are mastered; monitoring of early education settings to maintain fidelity of implementation; developing materials that describe and support implementation; evaluating the efficacy of the system to examine the impact of the changes; and creating policies and procedures needed to maintain the system once it is developed.

Recommendations for the Early Childhood Field

THIS DOCUMENT DESCRIBES AN INITIATIVE focused on conceptualizing and establishing an evidence base for an emerging practice called Recognition and Response. Rather than being an academic exercise, this collaborative effort reflects the real challenges of moving evidence-based concepts from theory into practice. The process of conceptualizing an early intervening system for use with prekindergartners (i.e., 3 to 5 year-olds) has been informed by an evidence-based approach that relied on the following steps: (1) conducting a comprehensive review of the empirical and conceptual literature on RTI, and (2) creating a dynamic community of practice consisting of key stakeholders who engaged in extensive discussions and deliberations to identify essential components of the proposed Recognition and Response system. The goal of this initiative in coming years is to develop the materials, tools, and processes that will serve as the infrastructure for implementing the proposed Recognition and Response system. We offer the following recommendations to the early childhood field to support future development, evaluation, and adoption of the Recognition and Response system:

1. Further develop the Recognition and Response system by (1) specifying in more detail each of the four components (i.e., an intervention hierarchy; screening, assessment, and progress monitoring; research-based curriculum, instruction, and focused interventions; and a collaborative problem-solving process for decision-making); and (2) creating the tools and resources related to implementing each component.

2. Evaluate the efficacy of the Recognition and Response system through future research. This is particularly important, given that the emerging body of empirical evidence for RTI does not include children prior to kindergarten entry. Initially, evaluation efforts should focus on assessing how the tools and resources are viewed by parents and teachers, whether they are used in the intended manner, and the extent to which they lead to more informed decision-making to address children's early learning difficulties. A subsequent goal of evaluation efforts will be to assess whether the Recognition and Response system works under carefully controlled conditions with a high level of support. Ultimately, the aim is to understand the effectiveness of the Recognition and Response system in naturalistic settings on a much larger scale and in a variety of contexts.

3. Establish approaches to professional development as the primary vehicle for disseminating information about the Recognition and Response system to front-line early childhood professionals—teachers, specialists, and administrators. Curricula, practice guidelines, and other written products should be developed in conjunction with professional development efforts to ensure that training is delivered in a consistent manner and that practitioners acquire the knowledge, skills, and dispositions needed to implement the Recognition and Response system. In addition to formal coursework and continuing education opportunities, consideration should be given to innovative models such as coaching, consultation, and communities of practice that are designed to support teachers' utilization of knowledge in practice (Wesley & Buysse, in press a.; Winton, in press).

4. Develop and evaluate dissemination strategies for print, electronic, and oral presentation methods that communicate information about the Recognition and Response system to a wide audience that includes parents of young children, researchers, policymakers, and the general public. A dissemination plan should include the following steps: (1) identifying target audiences; (2) determining the content and relevant information for each audience; (3) designing the content and format of products; (4) using focus groups or social marketing strategies to test each product prior to dissemination; and (5) evaluating the effectiveness of the dissemination plan. Examples of the types of products that could be used in dissemination efforts include scholarly journals and books, Web sites and Web-based publications, teleconferences, presentations at national conferences and professional meetings, policy briefs, magazine articles, fact sheets, handouts with frequently asked questions, and brochures.

5. Develop or adapt existing public policies related to program standards and professional competencies to support the widespread adoption and implementation of the Recognition and Response system throughout various sectors of the early childhood field (e.g., child care centers and homes, public and private pre-k programs, Head Start). To accomplish this goal, policymakers will need to rely on an evidence-based approach in which the primary aim is to integrate reliable, valid, and relevant scientific research with the early childhood field's collective wisdom and values (Wesley & Buysse, in press b.). Although it seems logical to rely on science to inform policy decisions, the lack of empirical evidence in the case of an emerging area of practice (i.e., the Recognition and Response system) underscores the critical importance of considering other sources of information, including whether a promising practice is based on sound educational theories and principles. Public policy also should inform researchers about areas of practice, such as the proposed Recognition and Response system, that require additional research and allocate resources for this purpose. ■

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Author(s)	Purpose	Research design	No. of subjects	Ages & characteristics of subjects	Independent variable(s)	Student measure(s)
1. Burns & Senesac (2005)	Compare the validity and diagnostic implications of four dual discrepancy (DD) models.	Causal-comparative	146 students nominated by teachers for reading difficulties.	1st, 2nd, and 3rd grades in 9 schools.	Four normative criteria to assess growth in reading skills (25th, 33rd, & 50th below mean).	• Dynamic Indicators of Basic Early Literacy Skills (DIBELS) • Gray Oral Reading Test (GORT-4)
2. Case, Speece, & Molloy (2003)	Examine the validity of RTI.	Causal-comparative augmented by qualitative classroom observations and teacher interviews.	36 children at-risk for reading disabilities defined as lowest 25% based on CBM probes.	1st and 2nd grade students in one elementary school in a large, suburban mid-Atlantic state school district.	Classification scheme based on frequency of identification of DD.	• Background variables • Woodcock-Johnson sychoeducational Battery-Revised (WJ-R) • Comprehensive Tests of Phonological Processing (CTOPP) • Rapid object naming • Social Skills Rating System-Teacher (SSRS) • WISC-R (4 subscales) • Curriculum-based measures (Letter Sounds Fluency; LSF and Oral Reading Fluency; ORF) • Number of services received • The Instructional Environment Scale-II (TIES-II) • Classroom observations with fieldnotes Classroom observations with fieldnotes • Teacher background
3. Coyne, Kame'enui, Simmons, & Harn, (2004).	Determine whether a supplemental intervention in first grade was required to maintain the effects of a beginning reading intervention initiated in kindergarten.	Experimental with participants randomly assigned to an experimental group and a control group.	59 children who were identified as the strongest responders to a kindergarten intervention in a previous study.	1st grade students in two suburban school districts in western Oregon.	(1) Classroom reading instruction (phonological awareness, decoding strategies, text reading); (2) Experimental condition (phonological awareness and alphabetic skills using "Write Well" program).	• Phoneme segmentation fluency • Nonsense word fluency • Oral Reading Fluency (ORF; Deno, 1989) • Woodcock Reading Mastery Test-Revised (WRMT-R)

Author(s)	Purpose	Research design	No. of subjects	Ages & characteristics of subjects	Independent variable(s)	Student measure(s)
4. Fuchs, Compton, Fuchs, Paulsen, Bryant, & Hamlett (2005)	(1) Examine the effects of preventive tutoring, (2) estimate the prevalence and severity of mathematics disability at the end of first grade, and (3) explore the cognitive abilities associated with mathematics competence in first grade.	Experimental with 3 groups: At-risk-Tutored; At-risk-Control; Not At-risk-Control	127 of the lowest performing students identified as at-risk and 437 not-at-risk students.	First grade students in Title I and non-Title I schools.	Small group math tutoring	• 7 math measures (CBM computation, addition, fact fluency, subtraction fact fluency, first-grade concept/applications, story problems, Woodcock Johnson III (WJ III) Applied Word Problems & WJ III Computation). • Woodcock Reading Mastery Test-Revised (WRMT-R) • Wechsler Abbreviated Scale of Intelligence (WASI) • Woodcock Diagnostic Reading Battery (WDRB) • Comprehensive Test of Phonological Processing (CTOPP) • Woodcock-Johnson Psychoeducational Battery-Revised (WJ-R) • Working Memory Test Battery for Children (WMTB)
5. Fuchs, Fuchs, & Prentice (2004)	Determine whether students' responsiveness to generally effective classroom instruction on math problem solving varied as a function of risk status.	Experimental with stratified random assignment of teachers to treatment and control groups across 4 disability risk groups: (1) no disability risk (NDR); (2) at risk for math and reading disabilities (MDR/RDR); (3) at risk for math disabilities (MDR); and (4) control group.	201 students at risk and not at risk.	Third grade.	Mathematical problem-solving instructional intervention	• Terra Nova state assessment (CTB/McGraw-Hill, 1997) • Understanding computation, and labeling scores for two problem-solving measures: immediate and near-transfer

Author(s)	Purpose	Research design	No. of subjects	Ages & characteristics of subjects	Independent variable(s)	Student measure(s)
6. McMaster, Fuchs, Fuchs, & Compton (2005).	Explore the validity of the dual-discrepancy approach and compare the achievement of nonresponders who received one of three interventions.	Experimental with children stratified by low vs. very low scores on CBM and then randomly assigned to one of three treatment groups.	56 children	First grade children from 4 Title I schools and Non-Title I schools.	(1) PALS, (2) Modified PALS, and (3) Individualized tutoring	• Rapid naming (RLN; Fuchs et al., 2001 and the Rapid Letter Test; Levy & Lysunchuk, 1997) • Yopp-Singer Phonological Awareness Test (1988) • Woodcock Reading Mastery Test-Revised (WRMT-R) • Wechsler Individual Achievement Test (WIAT) • Near-transfer reading passages • Far-transfer reading passages and comprehension • Dolch probes (CBM measure) • Nonword fluency probes (CBM measure)
7. O'Connor (2000)	Evaluate layered approach to reading intervention and its effects on responsiveness for children at-risk for reading disabilities over a 2 year period.	Regression discontinuity.	146 children in three schools in an urban school district.	4.8-7.1 yrs. at entry to kindergarten across the three schools, 70% received free or reduced price lunch.	Layer 1: Ladders to Literacy; Layer 2: One-to-one tutoring; Layer 3: Grade 1 small groups; Layer 4: One-to-one blending and spelling.	• Woodcock-Johnson Tests of Achievement (WJ) • PPVT-R • Sound repetition • Rapid animal naming • Rapid letter naming • Blending • Segmenting • Syllable deletion • Rhyme production
8. O'Connor, Harty, & Fulmer (2005).	Examine the effects of second- and third-tier interventions on students' reading achievment.	Quasi-experimental with 3 intact groups: 1) students at-risk for reading disabilities; 2) students with disabilities; 3) historical control group	37 students	K - 3rd grade.	Layer 2: Small Group Reading Instruction, 3 days per week; Layer 3: Daily Small-Group Reading or Individual Instruction.	• Woodcock Reading Master Test-Revised-Normative Update (WRMT-R/NU) • Oral reading fluency (Deno, 1985) • PPVT - III
9. O'Connor, Fulmer, Harty, & Bell (2005)	Evaluate the effects of intervention layers on reading achievment over time.	Quasi-experimental with 2 intact treatment groups (layers 1 & 2) and historical controls.	All students in kindergarten (n=103) and Grade 1 (n=103) who were enrolled in 2 schools	K -3rd grade.	(1) Layer 1: Professional Development; (2) Layer 2: Direct Reading Intervention.	• Phonemic segmentation • Letter naming • Woodcock Reading Master Test-Revised • Peabody Picture Vocabulary Test, 3rd edition (PPVT-III) • Oral reading fluency • Teacher surveys
10. Speece & Case (2001)	Compare dual discrepancy (Curriculum-Based Measurement; CBM) with IQ-reading achievement discrepancy.	Causal-comparative	273 children (144 at-risk, 129 purposive sample selected to reflect full range of grade level reading skills).	1st and 2nd grade students.	Children were assigned to 3 groups: 1) CBM dual discrepancy; 2) IQ-reading achievement discrepancy; 3) low achievment.	• Letter Sounds Fluency (LSF) and Oral Reading Fluency (ORF) (curriculum-based measures) • Wechsler Intelligence Scale for Children-Revised (WISC-R) • Woodcock-Johnson Psycho-educational Battery-Revised (WJ-R) • Comprehensive Tests of Phonological Processing (CTOPP) • Social Skills Rating System (SSRS) • Child information

Author(s)	Purpose	Research design	No. of subjects	Ages & characteristics of subjects	Independent variable(s)	Student measure(s)
11. Torgesen & Davis (1996)	Analyze individual differences in response to a training program and identify characteristics that predicted response to treatment.	Experimental with children randomly assigned to a treatment group and a control group.	100 children in two schools (60 treatment, 40 control).	Kindergarten children who scored below the 80th percentile on a measure of phonological awareness.	Phonological awareness training in small groups.	• Test of Phonological Awareness (TOPA) • Phoneme segmentation test • Sound isolation test • Phoneme blending • Naming rate for digits • Digit span test • Letter-name knowledge • Letter-sound knowledge • Reading nonwords • Spelling nonwords • Stanford-Binet Intelligence Scale-4th Edition
12. Torgesen, Wagner, Rashotte, Rose, Lindamood, Conway, & Garvan, (1999).	Examine the effectiveness of three instructional procedures for children who enter school delayed in phonological skill.	Experimental with 3 intervention conditions and a non treatment control condition.	180 children in 13 elementary schools (135 in treatment; 45 control).	Kindergarten-2nd grade children who obtained the lowest combined scores on the letter naming task and the phoneme elision task, and who had an estimated Verbal Intelligence score of above 75.	(1) Regular classroom support (RCS); (2) Embedded phonics (EP); (3) Phonological awareness plus synthetic phonics (PASP).	• Clinical Evaluation of Language Fundamentals-Revised (CELF-R) • Woodcock-Johnson Psychoeducational Battery-Revised (WJ-R) • Boston Naming Test • Stanford-Binet Intelligence Test, 4th edition • Woodcock Reading Mastery Test-Revised (WRMT-R) • Wechsler Intelligence Scale for Children-Revised (WISC-R) • Multigrade Inventory for Teachers (Agronin, Holahan, Shaywitz, & Shaywitz, 1992) • Test of Word Reading Efficiency (Torgesen, Wagner, & Rashotte, 1999) • Gray Oral Reading Test-III • Wide Range Achievement Test-Revised • Developmental Spelling Analysis (Tangel & Blachman, 1992) • Home Literacy Environment Rating Scale

Author(s)	Purpose	Research design	No. of subjects	Ages & characteristics of subjects	Independent variable(s)	Student measure(s)
13. Vaughn, Linan-Thompson, & Hickman (2003).	Feasibility of treatment model to identify students with reading disabilities.	Causal-comparative.	45 children at-risk for reading disabilities in three Title I schools in Texas.	2nd grade students.	Intervention components: (1) Phonemic awareness; (2) Phonics with attention to systematic mastery of sound-letter relationships; (3) Fluency; (4) Instructional level reading and comprehension; and (5) Spelling. Compared performance of students in 4 groups: 1) Met exit criteria at 10 weeks; 2) Met exit criteria at 20 weeks; 3) Met exit criteria at 30 weeks; 4) Exit criteria were never met.	• Texas Primary Reading Inventory: Screening (TPRI) • Test of Oral Reading Fluency (TORF) • Woodcock Reading Mastery Test-Revised (WRMT-R) • Comprehensive Test of Phonological Processing (CTOPP) • Woodcock-Munoz Language Survey

Author(s)	Purpose	Research design	No. of subjects	Ages & characteristics of subjects	Independent variable(s)	Student measure(s)
14. Vellutino, Scanlon, Sipay, Small, Pratt, Chen, & Denckla, (1996).	Evaluate the effects of tutoring to differentiate between reading deficits caused by cognitive deficits and those caused by experiential deficits.	1) Experimental with an intervention group, a control/contrast group, and a comparison group of normal readers; 2) Causal-comparative with poor readers divided into 4 groups: 1) Very limited growth; 2) limited growth; 3) Good growth; 4) Very good growth.	118 poor readers who were identified as poor readers and 65 normal readers randomly selected from the same classrooms.	First grade–2nd grade children in six school districts.	Daily one-to-one reading tutoring tailored to individual needs.	• Phoneme segmentation • Rapid automatized naming • Rapid articuluation • Clinical Evaluation of Language Fundamentals-Revised (CELF-R) • Woodcock Reading Mastery Test-Revised (WRMT-R) • Peabody Picture Vocabulary Test-Revised (PPVT-R) • Memory measures (sentence, words, visual, paired-associative learning)• Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R) • Concrete operations tasks • Modified matching familiar faces • Target Search Test • Letter identification • Word identification • Word attack • Print awareness • Print convention • Experimental math measure • Wechsler Intelligence Scale for Children-Revised (WISC-R) • Silent reading comprehension • Woodcock-Johnson Tests of Achievement-Revised (WJTA-R) • Phonological memory • Token test • Test of Language Development-Primary:2 (TOLD-P:2) • Grammaticality judgments • Oral reading of connected text • Oral cloze • DRS Listening Comprehension • Verbal fluency • General language processing • Recall of concrete and abstract words • Syntactic word order • Visuomotor and visuospatial abilities • Visual memory

Citation:
Main topic(s):
Type of article:

Background/context:

Purpose/objective/research question/focus of study:

Setting:

Populations/participants/research subjects:

Intervention/program/practice:

Research design:

Data collection and analysis:

Findings and results:

Conclusions and recommendations:

Appendix C
Experimental/Quasi-experimental Quality Indicators Rating Scale

Citation:		
Coder:		
Date:		

QUALITY INDICATORS FOR GROUP EXPERIMENTAL AND QUASI-EXPERIMENTAL RESEARCH ARTICLES

Description of Participants

1. Sufficient information was provided to determine/confirm whether the participants demonstrated the disability(ies) or difficulties presented.*

4	3	2	1
Adequate	Partial	Inadequate	Unknown

2. Appropriate procedures were used to increase the likelihood that relevant characteristics of participants in the sample were comparable across conditions.*

4	3	2	1
Adequate	Partial	Inadequate	Unknown

3. Sufficient information was given characterizing the interventionists or teachers and that they were comparable across conditions.*

4	3	2	1
Adequate	Partial	Inadequate	Unknown

4. Data were available on attrition rates among intervention samples.**

4	3	2	1
Adequate	Partial	Inadequate	Unknown

*Essential quality indicators
**Desirable quality indicators

From Gersten, R., Fuchs, L.S., Compton, D., Coyne, M., Greenwood, C., & Innocenti, M.S. (2005). Quality indicators for group experimental and quasi-experimental research in special education. *Exceptional Children, 71(2)*, 149-164.

5. Overall attrition was less than 30%.**

4 Adequate	3 Partial	2 Inadequate	1 Unknown

6. Attrition was comparable across samples.**

4 Adequate	3 Partial	2 Inadequate	1 Unknown

Implementation of the Intervention and Description of Comparison Conditions

1. The intervention was clearly described and specified.*

4 Adequate	3 Partial	2 Inadequate	1 Unknown

2. The fidelity of implementation was described and assessed.*

4 Adequate	3 Partial	2 Inadequate	1 Unknown

3. The nature of services provided in comparison conditions was described.*

4 Adequate	3 Partial	2 Inadequate	1 Unknown

4. The research team examined quality of implementation.**

4 Adequate	3 Partial	2 Inadequate	1 Unknown

5. Documentation of the nature of instruction provided in comparison conditions is explained.**

4 Adequate	3 Partial	2 Inadequate	1 Unknown

*Essential quality indicators
**Desirable quality indicators

From Gersten, R., Fuchs, L.S., Compton, D., Coyne, M, Greenwood, C., & Innocenti, M.S. (2005). Quality indicators for group experimental and quasi-experimental research in special education. *Exceptional Children, 71(2)*, 149-164.

6. Audio or videotape excerpts that capture the nature of the intervention were included.**

4	3	2	1
Adequate	Partial	Inadequate	Unknown

Outcome Measures

1. Multiple measures were used to provide an appropriate balance between measures closely aligned with the intervention and measures of generalized performance.*

4	3	2	1
Adequate	Partial	Inadequate	Unknown

2. Outcomes for capturing the intervention's effect were measured at appropriate times.*

4	3	2	1
Adequate	Partial	Inadequate	Unknown

3. The study provided not only internal consistency reliability but also test-retest reliability and interrater reliability (when appropriate) for outcome measures.**

4	3	2	1
Adequate	Partial	Inadequate	Unknown

4. Data collectors and/or scorers were blind to study conditions and equally (un)familiar to examinees across study conditions.**

4	3	2	1
Adequate	Partial	Inadequate	Unknown

5. Outcomes for capturing the intervention's effect beyond an immediate posttest (e.g., maintenance data) were measured.**

4	3	2	1
Adequate	Partial	Inadequate	Unknown

6. Evidence of the criterion-validity and construct validity of the measures was provided.**

4	3	2	1
Adequate	Partial	Inadequate	Unknown

*Essential quality indicators
**Desirable quality indicators

From Gersten, R., Fuchs, L.S., Compton, D., Coyne, M., Greenwood, C., & Innocenti, M.S. (2005). Quality indicators for group experimental and quasi-experimental research in special education. *Exceptional Children, 71(2)*, 149-164.

Data Analysis

1. The data analysis techniques were appropriately linked to key research questions and hypotheses, as well as the unit of analysis in the study.*

4	3	2	1
Adequate	**Partial**	**Inadequate**	**Unknown**

2. The research report included not only inferential statistics but also effect size calculations.*

4	3	2	1
Adequate	**Partial**	**Inadequate**	**Unknown**

3. Results were presented in a clear, coherent fashion.**

4	3	2	1
Adequate	**Partial**	**Inadequate**	**Unknown**

*Essential quality indicators
**Desirable quality indicators

From Gersten, R., Fuchs, L.S., Compton, D., Coyne, M., Greenwood, C., & Innocenti, M.S. (2005). Quality indicators for group experimental and quasi-experimental research in special education. *Exceptional Children, 71(2)*, 149-164.

Appendix D
Mean Scores for Individual Items from the Quality Indicators Rating Scale

Item	Mean score
Description of Participants	
Sufficient information was provided to determine/confirm whether the participants demonstrated the disability(ies) or difficulties presented.*	3.93
Appropriate procedures were used to increase the likelihood that relevant characteristics of participants in the sample were comparable across conditions.*	3.58
Sufficient information was given characterizing the interventionists or teachers and that they were comparable across conditions.*	3.18
Data were available on attrition rates among intervention samples.**	3.14
Overall attrition was less than 30%.**	2.86
Attrition was comparable across samples.**	2.31
Implementation of the Intervention and Description of Comparison Conditions	
The intervention was clearly described and specified.*	3.92
The fidelity of implementation was described and assessed.*	3.17
The nature of services provided in comparison conditions was described.*	3.45
The research team examined quality of implementation.**	3.17
Documentation of the nature of instruction provided in comparison conditions is explained.**	3.40
Audio or videotape excerpts that capture the nature of the intervention were included.**	2.50
Outcome Measures	
Multiple measures were used to provide an appropriate balance between measures closely aligned with the intervention and measures of generalized performance.*	3.21
Outcomes for capturing the intervention's effect were measured at appropriate times.*	3.93
Evidence of reliability and validity for the outcome measures was provided.*	3.21
The study provided not only internal consistency reliability but also test-retest reliability and interrater reliability (when appropriate) for outcome measures.**	2.57
Data collectors and/or scorers were blind to study conditions and equally (un)familiar to examinees across study conditions.**	1.86
Outcomes for capturing the intervention's effect beyond an immediate posttest (e.g., maintenance data) were measured.	1.67
Evidence of the criterion-validity and construct validity of the measures was provided.**	2.85
Data Analysis	
The data analysis techniques were appropriately linked to key research questions and hypotheses, as well as the unit of analysis in the study.*	4.00
The research report included not only inferential statistics but also effect size calculations.*	3.43
Results were presented in a clear, coherent fashion.**	4.00

*Essential quality indicators

**Desirable quality indicators

Author(s)	Stage of RTI	STP vs. problem solving	Results	Identification vs. intervention
1. Burns & Senesac (2005)	**Tier 1**: General classroom instruction and identification of nonresponders through the use of 4 different dual discrepancy (DD) approaches.	No intervention.	DD was most effective in identifying non-responsive students through the use of the 25th and 33rd percentile rank groupings.	Identification
2. Case, Speece, & Molloy (2003)	**Tier 1**: All students in grades 1 and 2 were screened to determine at-risk for reading failure. **Tier 2**: Collaborative consultation model; however, individualized interventions were not assessed. The purpose of the study was to determine the validity of a dual discrepancy approach to identification.	Problem solving - not evaluated.	Persistent nonreponsiveness to general instruction (defined by dual-discrepancy status) correlated with deficits on reading skills, and teacher ratings of behavior. The modified RTI paradigm was successful in identifying a group of children who needed special education services.	Identification
3. Coyne, Kame'enui, Simmons, & Harn, (2004).	**Tier 1**: All students participated in code-based general classroom reading instruction. All kindergarten participants screened for at-risk status. **Tier 2**: Students in the experimental condition received 30 additional minutes of small-group intervention.	STP • Phonological awareness • Alphabetic skills	Intervention (phonological awareness & alphabetic skills) effective in producing gains through February of 1st grade. No differences between groups with respect to intervention outcomes.	Intervention
4. Fuchs, Compton, Fuchs, Paulsen, Bryant, and Hamlett (2005)	**Tier 1**: At-risk (AR) for math disability and not at risk (NAR) students were identified through a whole-class format. **Tier 2**: Small-group math intervention delivered to group of AR students.	STP • Small-group math intervention	Reduced prevalence rate of MD as a result of the intervention; AR children improved on three posttest measures.	Identification of MD and intervention
5. Fuchs, Fuchs, & Prentice (2004)	**Tier 1**: All teachers followed the district's curriculum. Four groups of children were identified as at-risk or not-at-risk for a math and/or reading disability and were randomly assigned to a treatment or control group. **Tier 2**: Students in the treatment group received whole-class specialized math instruction.	STP	Students responded to intervention based upon risk status (no disability risk, at risk for comorbid math and reading disabilities, at risk for math disabilities only) with no disability risk students performing better than all of the other groups. MDR students grew more slowly on labeling and RDR students grew more slowly on computation.	Identification and intervention

Author(s)	Stage of RTI	STP vs. problem solving	Results	Identification vs. intervention
6. McMaster, Fuchs, Fuchs, & Compton (2005).	**Tier 1**: Classrooms initially used a standard version of PALS, fluency-building PALS, or no treatment. All children were screened and tracked for progress, which led to the identification of nonresponders. **Tier 2**: Some children were randomly assigned to small-group peer-tutoring **Tier 3**: Some children were randomly assigned to 1:1 tutoring interventions.	STP • PALS • Modified PALS • Tutoring	Dual discrepancy measures were reliable indicators of students' reading skill & nonresponders were identified. No differences between groups with regard to treatment effectiveness. There were statistically significant differences between groups in identifying nonresponders.	Identification and intervention
7. O'Connor (2000)	**Tier 1:** Whole-class teacher-led activities. At-risk children were identified through testing. **Tier 3**: 1:1 tutoring. Children's progress was tracked to identify nonresponsive students. **Tier 2**: Small group intervention. Screening identified students who did not respond to small group instruction. **Tier 3**: 1:1 tutoring.	STP • Introduction of letter sounds, phonemic blending and segmenting activities, phonetic decoding.	Interventions appeared to influence the percentage of children later identified as RD. Children in each layer of intervention progressed better than children who did not receive the intervention. Of the 14 children in the original sample eligible for special education by the middle of second grade, all were included in the high-risk sample in October of kindergarten.	Identification of children at-risk for reading disability and intervention
8. O'Connor, Harty, & Fulmer (2005).	**Tier 2**: Small group intervention. Standardized scores used to identify children in need of additional support. **Tier 3**: Daily small groups or individualized instruction.	STP • Segmentation, decoding, building vocabulary, fluency.	Direct early intervention for students eventually identified as RD showed moderate to large effect sizes over the historical control group. Special education placement averaged 15% in the historical control group. Following 4 years of participation, the rate of placement was 8%.	Identification and intervention
9. O'Connor, Fulmer, Harty, & Bell (2005)	**Tier 1**: Professional development to improve general education instruction. Children were assessed to determine eligibility for Tier 2 interventions. **Tier 2**: Small group instruction.	STP • Blending and segmenting activities, introduction to vowel sounds, smaller instructional sets.	Children in Layer 1 outscored the control in all of the reading measures except Word Identification at the end of grade 2. Children in classes where Layer 2 was available outscored the controls in all of the reading measures at both time points. Professional development alone improved reading outcomes significantly over the control group. The addition of direct intervention showed larger effect sizes over the control group and significant differences across all reading areas.	Identification and intervention
10. Speece & Case (2001)	**Tier 1**: All students in grades 1 and 2 were screened to determine children at risk for reading failure, which helped to determine the validity of a screening measure.	No intervention.	Curriculum-based measures (CBM) measures were effective in differentiating at-risk from not at-risk.	Identification of at-risk for LD

Author(s)	Stage of RTI	STP vs. problem solving	Results	Identification vs. intervention
11. Torgesen & Davis (1996)	**Tier 1**: Children who scored below the 80th percentile for phonological aware-ness were assigned to a treatment group and a control group. **Tier 2**: Small group instruction in both analytic & synthetic awareness skills (e.g., concept of rhyme, blending, segmenting)	STP	The training had a significant effect on the pattern of individual differ-ences in phonological awareness within the training group. The aver-age slope for the trained group of children in segmenting and blend-ing tasks was significantly higher than for the control group.	Identification of nonresponders and intervention.
12. Torgesen, Wagner, Rashotte, Rose, Lindamood, Conway, & Gar-van, (1999).	**Tier 1**: Children were selected to partici-pate based upon a two-level screening process: (1) all children given letter naming task and (2) bottom 30% given 3 additional tasks. **Tier 3**: 1:1 instruction.	STP • Regular classroom support • Embedded phonics (EP) • Phonological awareness + synthetic phonics (PASP)	Children in the PASP group had stronger skills than the EP group. Rapid naming, home background, and classroom behavior ratings were good predictors of response to instruction. Retention rates and the percentage of referrals to services also differed across conditions.	Identification and intervention
13. Vaughn, Linan-Thompson, & Hickman (2003)	**Tier 1**: Children were identified as at-risk using a two-level identification process: (1) teacher nomination and (2) screen-ing. **Tier 2**: Small group instruction.	STP • Phonemic aware-ness, phonics, fluency, reading & comprehension, spelling	Eleven of 45 students never met exit criteria. Of the 10 students who met exit criteria after 10 weeks, all continued to make progress for the next 10 weeks. For students who met mid-term exit criteria, only 9 of the 14 students continued on an acceptable trajectory for reading fluency. Rapid naming was the best predictor of responsiveness because it was the only one that showed significant differences between early exit and no exit students, mid exit and no exit students, and late exit and no exit students.	Identification and intervention
14. Vellutino, Scanlon, Sipay, Small, Pratt, Chen, & Denckla (1996).	**Tier 1**: Students were identified as poor readers by evaluating overall reading ability and through teacher rating. **Tier 3**: 1:1 tutoring	Combination STP/ problem solving • Intervention was tailored to the individual child's needs. Within each session, portions of time were devoted to specific skills (e.g., development of sight vocabulary, phonemic aware-ness, decoding, writing skills)	Children identified as poor readers scored below normal groups on the word identification and pseudoword decoding tests; phoneme seg-mentation, name encoding, name retrieval, and working memory reliably distinguished the normal group from the worst achieving tutored group, and the best achiev-ing group from the worst achieving tutored group.	Identification and intervention